

REMARKS

Claims 1-24 and 26-49 are currently pending. Claims 34-49 are withdrawn from prosecution. In the Office action dated May 31, 2006, claims 1, 2, 5, 8-13, 15, 16, and 20-23 are rejected under 35 U.S.C. § 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over U.S. Patent Application Publication No. 2003-0232495 of Moghadam et al. Claims 3, 4, 6, 7, 14, 17, 18, 19, 29, 30 and 33 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Moghadam in view of U.S. Patent No. 6,450,116 to Noble. Claims 3, 19, 24, 26-28, 31 and 32 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Moghadam and Noble in view of U.S. Patent No. 6,806,211 to Shinriki.

§ 102 Rejections

First, Applicants respectfully traverse the rejection of claim 1 as anticipated by Moghadam, for at least the reason that substantive claim elements that distinguish this claim from Moghadam were improperly not considered. For example, in the Office action at page 3, lines 8-10, it is asserted that the recitation of claim 1 that “the composite polymer dielectric film include[es] a low dielectric constant polymer layer disposed between and chemically bonded to a first silane-containing layer and a second silane-containing layer” is a claim limitation of intended use.

Applicants respectfully traverse this assertion. This element of claim 1 is functional descriptive material under MPEP § 2106 in that it states an order of the first, second and third intervals recited in claim 1. For this structure to be deposited, the first interval begins before the second interval, and the second interval begins before the third interval. To clarify that this element is functional descriptive material, claim 1 is amended herein to recite that the instructions stored on the memory are executable by the processor to control the silane delivery

system to deposit the silane precursor on the substrate for a first interval to form the first silane-containing layer, next to control the process module to deposit the gas phase monomer on the first adhesion promoter layer for a second interval to form the low dielectric constant polymer layer, and next to control the silane delivery system to deposit the silane precursor on the low dielectric constant polymer layer for a third interval to form the second silane-containing layer.

Turning to the references cited against claim 1, Moghadam does not explicitly or inherently teach all of the elements of claim 1 as amended. Instead, Moghadam discloses (for example, at paragraph [0052]) depositing mixtures of organo-silicon compounds, or mixtures of organo-silicon compounds and hydrocarbons, and then processing the resulting films via an electron beam treatment. Where Moghadam discloses depositing an organo-silicon compound and a hydrocarbon, the compounds are disclosed as being deposited simultaneously in a mixture to form a mixed film, rather than in sequential intervals to form discrete layers of films having different compositions. For example, all seven example CVD methods disclosed between paragraphs [0074] and [0121] teach depositing an organo-silicon compound and a hydrocarbon simultaneously.

In the Office action at page 7, section xiv, it is asserted that Moghadam teaches that its program control as operable in a cyclic method at paragraph [0131]. However, contrary to this assertion, paragraph [0131] goes on to state that the multiple process step cycles are cycles of thermal deposition and e-beam treatment processes. Therefore, this paragraph teaches only that the entire process of Moghadam may be repeated, and does not teach controlling a silane delivery system to deposit the silane precursor on the substrate for a first interval to form the first silane-containing layer, next controlling the process module to deposit the gas phase monomer on the first silane-containing layer for a second interval to form the low dielectric constant

polymer layer, and next to control the silane delivery system to deposit the silane precursor on the low dielectric constant polymer layer for a third interval to form the second silane-containing layer. For at least this reason, claim 1 as amended is not anticipated by Moghadam. Furthermore, claims 2, 5, 8-13, 15, 16, and 20-23 depend from and include all of the elements of claim 1, and are therefore also not anticipated by Moghadam. Applicants respectfully request these rejections be withdrawn.

§ 103 Rejections

Next, Applicants respectfully traverse the rejection of claim 1 as obvious over Moghadam. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Third, the prior art reference (or references when combined) must teach or suggest all the claim elements. MPEP § 2143. If proposed modification would render the prior art invention unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. MPEP § 2143.01 (*citing* In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)).

Claim 1 is not obvious over Moghadam for at least the reason that Moghadam contains no suggestion or motivation to make the proposed modification. In the Office Action, it is asserted at page 8, lines 1-5 that it would have been obvious to one skilled in the art to conduct interval depositions, and that the motivation to conduct interval depositions is for depositing plural films as taught by Moghadam at [0131]. However, as discussed above, paragraph [0131] of Moghadam discusses performing cycles of (1) a mixed film deposition via the simultaneous

deposition of multiple precursors, and (2) an electron beam treatment of the deposited film. In this manner, Moghadam teaches forming multiple layers of a single mixed film.

In contrast, claim 1 as amended recites instructions executable to deposit a silane precursor on the substrate for a first interval to form the first silane-containing layer, next to deposit a gas phase monomer on the first adhesion promoter layer for a second interval to form a low dielectric constant polymer layer, and next to control a silane delivery system to deposit the silane precursor on the low dielectric constant polymer layer for a third interval to form a second silane-containing layer. The recited apparatus of claim 1 therefore forms a composite film with discrete layers of different compositions, rather than multiple layers of a single composition.

Moghadam does not provide a suggestion or motivation for the cited modification for at least the reason that the proposed modification would render the device of Moghadam unsuitable for its intended use. The low dielectric constant films of Moghadam are configured to be porous and cross-linked. As described at paragraph [0042] of Moghadam, the films contain one or more cyclic organo-silicon-based compounds, one or more acyclic organo-silicon-based compounds, and a hydrocarbon. As described at paragraph [0043] of Moghadam, the hydrocarbons may participate in cross-linking the cyclic organo-silicon-based compounds to give a greater degree of separation of the ring structures of the cyclic compounds, and therefore to provide a greater porosity for the film.

As discussed in Moghadam at paragraphs [0005]-[0006], porous films may have lower dielectric constants than non-porous films. The modification of Mogahadam to deposit the organo-silicon-based compound and the hydrocarbon at different times to form discrete layers of different compositions may result in the loss of the cross-linkage of the organo-silicon-based material in the Moghadam film, as the cross-linking hydrocarbon would be contained in a

separate layer from the organo-silicon-based compound. This may result in a film with decreased porosity and a higher dielectric constant. Therefore, the proposed modification may render the films produced by the Moghadam disclosure unsuitable for their intended purpose. For at least this reason, Moghadam does not suggest the modification of its process as cited in the Office Action, and claim 1 is not *prima facie* obvious over Moghadam.

Likewise, dependent claims 2-23 are not obvious over any of, or any combination of, Moghadam, Noble and Shinriki for at least the reason that these references, alone or in combination, fail to teach or suggest all of the elements of independent claim 1.

First, as discussed above for claim 1, Moghadam itself fails to suggest the modification cited in the Office Action. Likewise, neither Noble or Shinriki teaches or suggests instructions executable to deposit a silane precursor on the substrate for a first interval to form the first silane-containing layer, to deposit a gas phase monomer on the first adhesion promoter layer for a second interval to form a low dielectric constant polymer layer, and to control a silane delivery system to deposit the silane precursor on the low dielectric constant polymer layer for a third interval to form the second silane-containing layer.

Noble discloses a plasma processing system including separate chambers for generating a plasma and treating the substrate with the ions generated by the plasma. Noble does not disclose or suggest in any manner depositing a silane precursor for a first interval, a gas phase monomer for a second interval, and a silane precursor for a third interval. Likewise, Shinriki discloses a system that introduces a metal-containing gas and an oxidizing gas simultaneously into a chamber to form a single metal oxide film, and does not disclose or suggest the elements of claim 1. Therefore, Applicants respectfully request that these rejections be withdrawn.

Next, Applicants also respectfully traverse the rejection of claim 24 as obvious over

Moghadam in view of Noble. Nevertheless, Applicants herein amend claim 24 to recite memory and a processor in electrical communication with the process module, the post-treatment module and the silane delivery system, and instructions stored on the memory and executable by the processor to hold the substrate at a temperature of at least as low as -25 degrees Celsius while depositing the gas phase monomer. Furthermore, Applicants amend claim 26 to recite that the instructions are executable to hold the substrate at a temperature of between -30 and -50 degrees Celsius while depositing the gas phase monomer. The present specification teaches at page 19, last paragraph, that lower temperatures, including temperatures in this range, may allow the gas phase diradical monomer molecules to have sufficient energy to “bounce” on the surface of the first adhesion promoter layer so that the monomer diradical molecules can find an energetically favorable orientation. This may allow the low dielectric constant polymer layer to grow with a relatively high degree of crystallinity.

In contrast, Moghadam does not disclose or suggest at least these elements of claim 24. Moghadam discloses that a substrate may be maintained at a temperature of between -20 and 500 degrees Celsius, and more specifically between 100 and 400 degrees Celsius (see paragraph [0056]), suggesting that higher temperatures are preferable. Therefore, for at least this reason, Moghadam does not teach or suggest all elements of amended claim 24 or any claims depending therefrom.


Noble and Shinriki likewise do not disclose these elements of amended claim 24. Noble discloses heating a substrate to a temperature of between 800 and 1100 degrees Celsius for nitridization (Noble, col. 4, ll. 1-5), and Shinriki teaches holding a substrate at a temperature to form a metal oxide from non-oxide precursors (for example, 200-450 degrees Celsius in the case of the reaction of $ZrCl_4$ and $SiCl_4$ with water to form $ZrSiO_4$) (Shinriki, col. 8, ll. 40-65).

For at least these reasons, claims 24 and 26-33 are not *prima facie* obvious over Moghadam alone or in combination with Noble and/or Shinriki.

Applicants believe that this application is now in condition for allowance, in view of the above amendments and remarks. Accordingly, Applicants respectfully request that the Examiner issue a Notice of Allowability covering the pending claims. If the Examiner has any questions, or if a telephone interview would in any way advance prosecution of the application, please contact the undersigned attorney of record.

CERTIFICATE OF MAILING

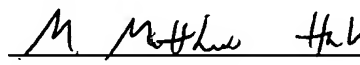
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